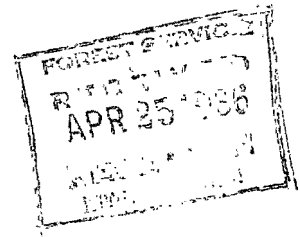


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COMMENTS ON TIMBER STAND IMPROVEMENT

IN THE CENTRAL STATES

Willis M. Baker, Director

With the initiation of emergency conservation work in the central hardwood region, the foresters of many organizations have been called upon suddenly to undertake extensive projects of timber stand improvement as a means of employing C.C.C. or relief labor, or to demonstrate to woodland owners some of the silvicultural measures of timber production. This has brought about a situation that should be called to the attention of those engaged in, or responsible for, this work.

Heretofore very little timber stand improvement has been attempted in the Central States except for a few instances in the farmwoods of the Corn Belt, where conditions are quite different from those encountered within the more heavily forested hill-sections of the unglaciated region to the south. Lack of funds and facilities for research has prevented or delayed studies of many of the silvicultural problems involved in the management of the forest types with which public agencies are now concerned. Consequently, much of the information essential to successful cultural operations is not available. Most of the foresters engaged in these new projects have necessarily been brought in from other regions, and, under the circumstances which exist, they have been forced to depend largely upon their experiences elsewhere, or upon the results of similar work in other sections of the country.

Even though many of the tree species encountered in the Central States are also found over most of the eastern states, it does not necessarily follow that they have the same relative value or that the same silvicultural methods will prove successful here. In fact, local conditions of site and climatic influences which become more critical as the prairie region is approached, inject into the silviculture of the central hardwoods many problems peculiarly local and often difficult of solution. To those foresters who may not appreciate this situation, a few suggestions based upon recent studies and observations may prove helpful, although it should be frankly stated and clearly realized that the available knowledge of stand improvement work in this region is woefully meager. Sound recommendations as to methods to use and results to be expected must await the outcome of research investigations, which in many instances have not yet been authorized or started. A discussion of some of the problems may arouse interest and lead to valuable observations from foresters working in the field of silvicultural management.

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Grazed Woods. On millions of woodland acres in the Central States timber stands have been depleted and growing sites have been deteriorated by continued grazing of livestock. This situation has become most serious in the farmwoods of the Corn Belt, but the harmful results of over-grazing are apparent throughout the central hardwood region. Better methods of land use, such as increased development of improved pastures following a reduction of cultivated crops on steep slopes or on easily eroded soils, may help to relieve excessive woods grazing in some sections (3).\*

The typical severely grazed woods consists of an over-story of large trees and a more or less complete sod cover on the ground, with a conspicuous absence of an under-story of younger tree growth. A forester, unfamiliar with the problems presented by this condition and realizing the necessity for securing regeneration, might conclude that the overhead stand needed opening by the removal of overmature or inferior trees, especially those of undesirable species. Or, finding an abundance of recent seedling reproduction over the area, he might decide that a partial removal of overhead shade would aid them to develop. In both instances he would be following the worst possible procedure.

In the study of grazed woodlands in Indiana, conducted by the Station in cooperation with the Purdue Department of Forestry, Day and DenUyl (4) found that, in the more open woodlands with a complete sod cover, tree reproduction had the greatest difficulty in becoming established, or in growing satisfactorily after initial establishment. Frequently seedlings of various species start abundantly in the spring, appear promising during early summer, only to fail before the end of the growing season. Some of the more persistent may hang on for several years without making more than a few inches of height growth. Working on this same project, Diller (5) has described the adverse conditions of moisture and temperature which prevent or delay the regeneration of tree species on the compacted soils of woodlands opened up excessively by livestock browsing and trampling. Further cutting only aggravates the situation. Apparently the best stand improvement measure is merely to protect such woodlands in the hope that, after the elimination of live stock, sooner or later the combined influences of shade and undisturbed accumulations of leaf litter may gradually reduce the sod cover and restore forest soil conditions more favorable to hardwood reproduction. Not until this stage of restoration occurs should any cutting of trees be considered. Numerous attempts have been made to speed up this process by underplanting or interplanting with various species, but with very few exceptions these efforts have resulted in complete failure, chiefly because of the adverse site conditions created by years of over-grazing. It appears probable that site preparation by plowing or by some other method might aid materially in the establishment of planted or natural reproduction. Further investigations of these problems are obviously needed.

Old Field Stands. Throughout the poorer agricultural sections of the central hardwood region millions of acres of worn-out, abandoned farm lands are being reforested - some artificially with planted trees and others by natural reproduction. In localities where seed trees occur the native yellow pines, red cedar, and black locust encroach aggressively upon abandoned lands; but throughout the region sassafras, persimmon, and

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\*Numbers refer to literature cited, page 6.

other species of minor importance commercially are the ones which most commonly reoccupy old fields or pastures. Occasionally the more valuable hardwoods are able to reproduce, where seed has been available under conditions favorable for germination and establishment, but more often the better hardwoods come in later after forest conditions have been restored by a nurse-crop cover of sassafras or some other little-appreciated weed trees. These latter are a blessing in a disguise that many foresters apparently have been unable to penetrate, judging from the treatment to which the minor species are often subjected when a "stand improvement" job is attempted.

Unless or until there are enough trees of desirable species established to form the potential final crop and to benefit from weeding or liberation cutting, it is futile to attempt stand improvement work in young growth of the so-called weed species. In many old-field stands they usually predominate during their relatively short life-time, and the better species come in gradually as the nurse cover matures and thins out. A premature cutting only delays the final conversion, for the weed species invariably reproduce immediately and prolifically either from seeds or sprouts, or both. In stands where there are scattered trees of the desirable species, a limited amount of liberation cutting or thinning around each may be justified, but any attempt to eliminate the inferior species by cutting should be avoided, at least until we have learned if and how this conversion process may be aided.

It is likewise inadvisable to attempt an improvement cutting in an old-field stand, regardless of the composition of its species, if the trees have not thoroughly established forest conditions of ground litter and crown cover. Stand improvement work has been proposed, in some instances, for stands in which grasses, weeds, and other old field vegetation such as blackberry, crataegus, etc., have not yet been eliminated. It should be evident that forest restoration has not been completed, and to open up the stand further by premature cutting merely defeats or delays the process.

Upland Oak Types. Various species of oak, of which white oak is the most abundant and important, predominate in the more or less xerophytic associations of the oak-chestnut, oak-hickory, and oak-pine types that cover extensive areas of upland forest in the central hardwood region. Among the factors which contribute to the local occurrence and growth of tree species, one of the most important is soil moisture, and this in turn is dependent upon climate as well as upon soil formation and structure which influence the absorption, retention, and drainage of water. As the prairie region is approached, one would expect to find seasonal or periodic fluctuations in precipitation and frequent deficiencies in soil moisture tending to create conditions which only xerophytic species could endure. Chapman (2) has pointed out, in his study of natural forest associations, that site deterioration following clearing, livestock grazing, or burning, tends to prevent the reestablishment of species exacting in their soil and moisture requirements. The typical upland oak forest of today occurs on lands too poor to have been cleared for farming, or on lands which have reverted to woods following agricultural exhaustion. Excessive cutting, erosion, livestock grazing, or repeated fires have usually brought about more or less deterioration of site along with depletion of growing stock. The forester, in deciding upon measures of silvicultural treatment, must give due consideration to these facts.

Even under more favorable conditions it is doubtful if the upland oak forests on relatively dry sites are capable of producing satisfactory all-aged or two-story stands. The oaks and most of the associated species, such as hickory, ash, yellow poplar, etc., generally regarded as valuable, are relatively intolerant, and while their seedlings may start under considerable shade, they invariably grow little or not at all unless released promptly from all competition. Kuenzel's study (8) of chestnut oak reproduction in southern Indiana demonstrated the failure of oak seedling and sprout growth under the partial shade of a thinned stand. Similar results with white oak and other species have been observed repeatedly by the writer. Except under site conditions of fertility and moisture more favorable than those usually found in the upland oak types, the major species are not able to endure the competition encountered in the under-story of the forest.

On the other hand, most of the minor or less desirable species commonly found with oaks, such as dogwood, red maple, sassafras, black gum, ironwood, witchhazel, etc., are more tolerant and usually hang on persistently in the under-story. As a result, any slight opening of the overhead stand usually favors these undesirables, which immediately occupy the space to the exclusion of the more valuable species. This fact has been well brought out by Aughanbaugh (1) in his study of the establishment and growth of oak and associated species following the death of chestnut in Pennsylvania. He found seedling reproduction of both desirable and undesirable species in the openings vacated by the chestnut, but on the less favorable sites the better species invariably were being crowded out by the more rapid growth of the aggressive undesirables.

Under the conditions herein considered, stand improvement measures should be adopted with caution. In fully stocked young stands weeding, liberation cuttings, and thinnings may be undertaken in moderation to benefit potential final crop trees, but too heavy cuttings may introduce or encourage an under-story of tolerant undesirables which may prove very embarrassing to the forester at the time for final cutting. In older stands the best methods apparently are either to open the overhead crown very little by selection or improvement cuttings, so that the inferior under-story may be kept under control, or to provide large openings by heavy cuttings so that the better species may have ample opportunity, with the aid of liberation cutting as necessary, to reproduce and grow. From present knowledge it appears that the upland oak forests on relatively dry sites may be best adapted to management as even-aged stands. These may cover an entire area or they may be confined to selected groups just large enough to permit optimum development of the trees from seedling stage to maturity.

Oak Pine. Native yellow pines - shortleaf, Virginia, and pitch - are local associates of upland oaks on dry sites within the unglaciated sections of the region. Shortleaf pine is the most important and abundant of these species; extensive areas of the oak-shortleaf pine type are found in the Ozarks, and to a less extent in southern Ohio. Following settlement by the white man it is probable that the local distribution of yellow pines has been considerably extended, because of conditions favorable to their reproduction having been created by the abandonment of old fields, or by the opening up of the original hardwood stands through burning, grazing, or cutting. As forest sites deteriorate and become less favorable for hardwood reproduction, the less exacting pines find greater opportunity for development. For this reason Chapman (2) has advocated planting native pines on the poorer sites of the region. It would also appear logical to assume that,

if forest conditions favorable to hardwoods can be restored through protection and conservative management, the pines may be expected to find it increasingly difficult to maintain their present advances except on the poorer sites.

Many of the drier ridges and slopes of the Ohio Valley now occupied by scrubby, slow-growing oaks, or similar sites in the Ozarks on which post oak and blackjack oak now exist, would undoubtedly prove more productive if converted to stands of pine and oak. Such sites are at present incapable of supporting good hardwood stands. Where pine seed trees exist this may be accomplished by a partial or complete cutting of the oak at the time of a pine seed crop. If pine reproduction cannot be secured naturally it may prove advisable in some instances to plant pine in openings between oak stumps following clear-cutting.

Mesophytic Types. Mixed stands of various hardwood species, including many of those usually regarded as most valuable, are found throughout the Central States wherever local conditions of soil and moisture are favorable. Within the unglaciated hill country they are most common on fertile bottomlands along streams, in protected coves, or on moist lower slopes. Yellow poplar, white and red oak, hickory, ash, walnut, cherry, beech, maple, and elm are some of the species frequently found in mixture with others of equal or less value. Under the favorable conditions of site such stands are usually thrifty, grow vigorously, and are relatively free from serious damage from fire, insects, or disease. Of course this may not be true of abused or heavily culled stands, and Hepting (7) has reported serious defect in the extensive hardwoods of the Mississippi bottoms as a result of frequent fires.

From the standpoint of timber stand improvement the mixed hardwoods provide the forester with some of the most promising opportunities for cultural work, and at the same time the problems of silviculture encountered usually are less difficult than those presented by other forest types. Mixed hardwoods often occur as all-aged forests which respond favorably to selection cutting management. Where conditions for growth are optimum, even relatively intolerant species like yellow poplar and white oak are able to survive and overcome competition which they could not endure on less favorable sites. Seedling reproduction usually establishes promptly and grows vigorously as openings in the overhead stand are made; however, to secure regeneration of the species desired may require careful consideration of the time of cutting, and possibly subsequent weedings and liberation cuttings.

Most of the hardwoods also reproduce vigorously from sprouts, including the minor species of little value. In the management of all hardwood stands it is a question to what extent we should depend upon coppice regeneration. We need to know how to stimulate sprout growth where it may be desired, and how to control it where it is not wanted. Diller (6) has reported upon the results of cutting methods to reduce the sprouting of hop-hornbeam, but much more work of this kind is urgently needed. Problems of girdling and pruning also require investigation.

Conclusion. In this paper the writer has endeavored to point out only a few of the more obvious problems involved in silvicultural management of the central hardwoods, for the benefit of those foresters, now engaged in stand improvement projects, who may not have had an opportunity to become thoroughly familiar with forest conditions in this region.

It is realized that the discussion has been negative rather than positive; difficulties to be recognized and avoided where possible have been emphasized, but no attempt has been made to outline the procedure covering various phases of improvement cutting for the great variety of forest conditions that exist. This cannot be done on a sound basis of fact until a comprehensive program of research has yielded the necessary information.

This is the situation that must be faced by those who would undertake stand improvement work in this region at the present time. Persons responsible for projects must realize the difficulties to be overcome, and the probability of unfavorable public reaction to unsatisfactory results or failures. Projects which are admittedly experimental should be restricted to an experimental basis or scope. Good judgment certainly counsels us to proceed with caution until we learn more about the job attempted.

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